CLAIMS

What is claimed is:

1. In an implantable cardiac stimulation device coupled to cardiac leads from which atrial and ventricular channel signals are generated, a method comprising:

tracking refractory periods within both the atrial and ventricular channel signals; and

determining an atrial rate using unipolar sensing outside the refractory periods and using combined unipolar/bipolar sensing within the refractory periods such that improved atrial rate determination is achieved.

2. The method of claim 1 wherein determining the atrial rate using unipolar sensing outside the refractory periods and using combined unipolar/bipolar sensing within the refractory periods is only performed if automatic mode switching (AMS) is enabled in the implantable stimulation device or if an atrial high rate detection diagnostic event counter is enabled, otherwise the atrial rate is determined based only on events outside the refractory periods sensed via unipolar sensing.

3. The method of claim 2 wherein determining the atrial rate using unipolar sensing based on events outside the refractory periods comprises:

identifying events occurring only on the atrial channel outside of the refractory periods;

identifying events occurring simultaneously on the atrial and ventricular channels outside of the refractory periods; and

determining an atrial rate by counting events that occur only on the atrial channel and while ignoring events that occur simultaneously on the atrial and ventricular channels.

4. The method of claim 1 further comprising opening relative refractory windows within the atrial and ventricular refractory periods and wherein the step of determining the atrial rate using combined unipolar/bipolar sensing within the refractory periods only applies to events within the relative refractory windows of the refractory periods.

5. The method of claim 4 wherein updating the atrial rate based on events detected inside the refractory periods using combined unipolar/bipolar sensing comprises:

identifying events sensed only on the atrial channel within the relative refractory windows as being true atrial events and counting the event for the purposes of atrial rate calculation;

identifying events sensed simultaneously on the atrial and ventricular channels within the relative refractory windows as being a ventricular event and ignoring for the purposes of atrial rate calculation; and

identifying events sensed only on the ventricular channel within the relative refractory windows as being noise and ignoring for the purposes of atrial rate calculation.

6. The method of claim 5 wherein, upon the identification of an event as being noise, a noise response function is activated.

7. The method of claim 4 wherein tracking atrial and ventricular relative refractory windows within the atrial and ventricular signals comprises:

detecting an R-wave on the ventricular channel;

initiating atrial and ventricular blanking intervals on the atrial and ventricular channels, respectively, following detection of the R-wave for a predetermined blanking period of time; and

initiating atrial and ventricular relative refractory windows on the atrial and ventricular channels, respectively, immediately

following completion of the atrial and ventricular blanking intervals for a predetermined relative refractory duration of time.

8. The method of claim 7:

wherein the ventricular blanking interval has a duration shorter than an average R-T interval occurring during normal sinus rhythm; and

wherein the ventricular blanking interval and the relative refractory window together have a combined duration longer than the average R-T interval of normal sinus rhythm such that the T-wave typically occurs during the ventricular relative refractory window.

9. The method of claim 7 wherein the atrial blanking interval has a duration equal to the ventricular blanking interval and the atrial relative refractory window has a duration equal to the ventricular relative refractory window such that the T-wave typically occurs during the atrial relative refractory window.

10. The method of claim 1 further comprising comparing the updated atrial rate against atrial tachycardia detection threshold (ATDR) threshold and performing a mode switch if the rate crosses the ATDR threshold.

11. In an implantable cardiac stimulation device, a system comprising:

a ventricular sense amplifier operative to sense ventricular channel signals; and

an atrial sense amplifier operative to sense atrial channel signals;

a control unit operative to track refractory periods within atrial and ventricular channel signals; and

an atrial rate determination unit operative to determine an atrial rate using unipolar sensing outside the refractory periods and using combined unipolar/bipolar sensing within the refractory periods.

12. In an implantable cardiac stimulation device, a system comprising:

means for sensing ventricular channel signals;

means for sensing atrial channel signals;

means for tracking refractory periods within atrial and ventricular channel signals; and

means for determining an atrial rate using unipolar sensing outside the refractory periods and using combined unipolar/bipolar sensing within the refractory periods.